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IS 12034 (1986) : Code of safety for methyl bromide [CHD 8 : Occupational Safety, Health and Chemical Hazards]

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IS : 12034 • 1986

Indian Standard

CODE OF SAFETY FOR METHYL BROMIDE

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**BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHAJUR SHAH ZAFAR MARG
NEW DELHI 110002**

Gr 3

November 1987

**AMENDMENT NO. 1 DECEMBER 2006
TO
IS 12034 : 1986 CODE OF SAFETY FOR
METHYL BROMIDE**

(Page 6, clause 4.1.1) — Substitute the following for the existing text:

‘TLV – TWA is 1 ppm (ACGIH)
A4 – Not classified as a human carcinogen’

(CHD 8)

Reprography Unit, BIS, New Delhi, India

Indian Standard

CODE OF SAFETY FOR METHYL BROMIDE

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(Continued on page 2)

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(Continued on page 12)

Indian Standard

CODE OF SAFETY FOR METHYL BROMIDE

0. F O R E W O R D

0.1 This Indian Standard was adopted by the Indian Standards Institution on 6 November 1986, after the draft finalized by the Chemical Hazards Sectional Committee had been approved by the Chemical Division Council.

0.2 Methyl bromide is used as a fumigant either as such or in admixture with other materials for control of pests of agricultural and animal husbandry products, such as fresh fruits and vegetables, plants and plant material, food grains, stored products like flour, dry fruits, timber, and hides and skins. It is also used as a soil fumigant.

0.3 Methyl bromide is a hazardous toxic chemical.

0.4 Pest Control Sectional Committee of Agricultural and Food Products Division Council and the Chemical Division Council has prepared IS : 1312-1980* which specifies requirements for methyl bromide with or without chloropicrin.

0.5 Methyl bromide is covered under the *Factories Act, 1948* and the rules by respective State Government thereunder. Methyl bromide is also covered under the *Gas Cylinder Rules, 1981* and the *Static and Mobile Pressure Vessels (Unfired) Rules, 1981* when stored in cylinders and pressure vessels respectively.

0.6 Considerable assistance has been derived from the following publications while preparing this standard:

- a) Occupational Health and Safety, Vol I, International Labour Office, Geneva (1972).
- b) Sax (N. Irving), Dangerous properties of industrial materials. 1979. Ed 5. Van Nostrand Reinhold Company, New York.
- c) Pesticide manufacturing and toxic material control encyclopaedia. Marshall Sittig; Noyes Data Corporation, 1980.
- d) Kirk-Othmer, Encyclopaedia of Chemical Technology. 1979. Ed 5. John Wiley, New York.
- e) Chemical Safety Data Sheet. Properties and essential information for safe handling, use of methyl bromide. 1949. Manufacturing Chemist Association, USA.

*Methyl bromide (second revision).

f) Hervey B. Ellinis. The chemistry of industrial toxicology 1959.
John Wiley & Sons Inc.

0.7 Some of the physical constants and other data is likely to marginally vary from source to source of information.

1. SCOPE

1.1 This standard covers properties of methyl bromide, the nature of hazards associated with it and essential information on storage, handling, packing, labelling, disposal of waste, cleaning and repair of containers, selection and training of personnel, personal protective equipment and first-aid.

1.2 This code does not deal with specifications for design of building, engineering and safety equipment, etc.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 4155-1966* shall apply.

3. GENERAL INFORMATION AND PROPERTIES

3.1 General Information — Methyl bromide is a dangerously poisonous chemical; it does not give any warning of leakage as it is a colourless and odourless gas above 3°56°C.

3.1.1 Common Names — Methyl bromide, bromo-methane.

3.1.2 Chemical Names — Methyl bromide.

3.1.3 Empirical Formula — CH₃Br.

3.1.4 Molecular Weight — 94.95.

3.2 Physical Properties

3.2.1 Description, Colour, Odour and Physical State — Under atmospheric pressure and above 3°56°C, it is in gas form. It is a liquid under pressure in cylinder. It is odourless and colourless to pale straw liquid at 0°C.

3.2.2 Melting Point/Freezing Point — (—) 93°6°C.

3.2.3 Boiling Point — 3°56°C at 760 mm pressure.

*Glossary of terms relating to chemical and radiation hazards, and hazardous chemicals.

3.2.4 Specific Gravity — 1·710 to 1·735 at 0/15°C.

3.2.5 Viscosity — 0·397 C.P. at 0°C.

3.2.6 Vapour Pressure — 1 824 mm Hg at 25°C.

3.2.7 Heat of Freezing — 15·05 cal/g at - 93·6°C.

3.2.8 Heat of Vapourization — 60·2 cal/g at 3·56°C.

3.2.9 Miscibility/Solubility in Common Solvents — Miscible with ethyl alcohol, ethyl ether and carbon tetrachloride in all proportions. Very soluble in chloroform, carbon disulphide and benzene. Very slightly soluble in water.

3.2.10 Incompatibility — Incompatible with aluminium, magnesium and zinc.

3.3 Chemical Properties

3.3.1 Affinity for other Chemicals — Powerful solvent for organic materials, especially natural rubbers, when pure, it is non-corrosive to most metals.

3.3.2 Important Common Reactions — Reacts with aluminium and aluminium alloys with the formation of trimethyl — a spontaneously ignitable material.

3.3.3 Stability at High Temperature — It is a stable gas at high temperature.

3.3.4 Whether Flammable, Non-Flammable or Supporter of Combustion — Methyl bromide is not ordinarily considered to be flammable. However, it will burn in air in the presence of a high energy source of ignition and when within narrow flammability range (N.F.P.A.).

3.4 Fire and Explosion Hazard Properties

3.4.1 Ignition Temperature — 537°C.

3.4.2 Explosive Limits Lower/Upper — Lower explosive limit in air is 13·5 percent by volume upper explosive limit (UEL) in air is ~ 14·5 percent by volume.

3.4.3 Spontaneous Heating on Combustion — Nil.

3.5 Corrosion Properties

3.5.1 Conditions When Corrosive — Non-corrosive to metals, other than in 3.2.10, under ordinary conditions of temperature and pressure.

4. HEALTH EFFECTS AND TOXICITY INFORMATION

4.1 General

4.1.1 Threshold Limit Value [Skin (See Note)] or Permissible Limit of Exposure Value — 5 ppm (20 mg/m³) for eight hours shift. Short term exposure limit (STEL) 15 ppm (60 mg/m³) of air.

NOTE — Skin refer to the potential contribution to the overall exposure by the cutaneous route including mucous membrane and eye, either by air borne or more particularly, by direct contact with the substance. Vehicles can alter skin absorption. This attention-calling designation is intended to suggest of cutaneous absorption so that the threshold limit is not invalidated.

4.1.2 Concentration Immediately Dangerous to Life — Single exposure to 1 000 ppm (4 000 mg/m³) can produce serious poisoning.

4.1.3 Exposure Concentration, Duration and Health Effects — The response of the persons exposed to breathing even in dangerous concentrations of methyl bromide gas may be delayed. They have shown little effect for sometime (from 1 to 48 hours after exposure).

The usual signs and symptoms are:

Dizziness	Slurred speech
Malaise	Nausea and vomiting
Head-ache	Laboured breathing
Blurred vision	Loss of appetite
Acute and profound tiredness	Abdominal pains
Staggering walk	Fainting

4.2 Routes of Entry

4.2.1 Most of the methyl bromide enters through respiration, skin and eyes.

4.3 Health Effects

4.3.1 Eyes — The vapours in contact with the eyes and also when inhaled leads to irritation, conjunctivitis, odema of eye-lids, or temporary blindness, diplopia, dilated pupils or/and mystagnius depending upon the dose and duration of exposure. Direct contact of liquid methyl bromide with the eye or eye-lids may cause serious injury to either or both.

4.3.2 Skin — High concentration of methyl bromide vapours may cause chemical burns of the skin with redness leading to blisters. Contact of large quantities of liquid methyl bromide with the skin or repeated contact of small quantities leads to an immediate sensation of tingling

and burning and numbness followed by acute pains. The skin at first appears red and slightly swollen. After several hours vesicles appear. Itching dermatitis can appear even after seven days of exposure. Usually, healing is followed by peeling of the skin.

4.3.3 Systemic — Exposure to small but harmful concentrations of methyl bromide over a period of time results in a varied picture of symptoms and signs, most of which are due to injury to the central nervous system and cardiovascular systems. In order of frequency of occurrence, these symptoms are visual disturbances, disturbances of speech, numbness of extremities, marked mental confusion, hallucination, tremors, coma or frequent fainting attacks. Most symptoms disappear in a few days, but the numbness of extremities and visual disturbances may occasionally persist from two to five months.

4.3.4 Organs or Systems Affected — Central nervous system, cardiovascular system, gastro-intestinal system and damage in the kidney, liver and adrenals.

NOTE — Minimum handling is recommended during the analysis of the methyl bromide in view of the hazardous nature of the chemical for example, in daily routine analysis the specific gravity should be determined by suitable hydrometer to minimise the exposure time.

5. STORAGE, HANDLING AND TRANSPORT

5.1 Storage

5.1.1 Usual Modes of Storage in Bulk or in Small Quantities and Types of Containers — Methyl bromide is a gas above 3.56°C at 760 mm/Hg pressure and hence is stored as a compressed gas in cylinder or tanks. Storage place should be away from any source of excessive heat. The cylinders should be kept upright and tightly capped in well ventilated dry, cool storage areas, secured from unauthorized persons. For storage of methyl bromide in cylinders and in tanks relevant provisions of *Gas Cylinder Rules, 1981* and *Static and Mobile Pressure Vessels (Unfired) Rules, 1981* should be strictly followed.

5.1.2 Ventilation in Storage Areas — Natural or mechanical ventilation should be provided to avoid or remove excessive concentration of methyl bromide vapours as a result of any leak in storage containers, pipes or cylinders.

5.1.3 Fire Prevention Measures in Storage Area — As the gas is not flammable no special specifications are necessary but normal fire fighting arrangements as provided for other non-flammable storage may be provided.

5.2 Handling and Transfer

5.2.1 Usual Method or Procedure for Handling and Transfer of Chemical from Storage Containers — Cylinders of methyl bromide have dip pipes reaching to the bottom. Cylinders must never be handled roughly, dropped, bumped or dragged and must never be unloaded by rope sling, hooks, tongs, magnets, etc. Heavier cylinders must be firmly cradled and secured for transfer on a suitable hand or fork truck, etc.

5.2.2 Problems Encountered, for Example, Spillage, Leakage and Preventive Measures — In case of any gas or liquid spillage or leakage, instruct all persons to move away to safer areas. If the spillage occurs in a closed areas, open all doors and windows and provide mechanical drought. In case of leaks, etc, only properly protected persons should be allowed to enter the areas. Normal working should not be resumed, unless it is made sure that the concentration of gas or vapours is within the safe limit.

5.3 Transport

5.3.1 Methods of Inplant Transport Used — Inplant transport of methyl bromide should always be kept at the minimum. The cylinders should be transported taking precautions as given in 5.2.1.

5.3.2 Methods of Transport Used Outside, Preventive and Precautionary Measures to Minimise Danger to Public — All precautions as specified for transportation of toxic chemicals in cylinders or tanks shall be followed as given in the relevant rules.

6. FIRE PREVENTION AND FIRE FIGHTING

6.1 Types of Extinguishing Agents and Equipment — As the gas is not flammable no special specifications are necessary but normal fire fighting arrangements (like water, dry chemical powder and carbon dioxide extinguisher).

7. SPILLAGE, LEAKAGE AND SCOPE OF MATERIAL

7.1 In case of leaks or spills, fire or explosion danger is not there, but on exposure, danger of toxic vapour is there.

7.2 Decontaminating Agents — Since methyl bromide has a boiling point of 3°56°C, the best decontaminating agent is natural ventilation and, if necessary, mechanical ventilation may be resorted to. Quick washing facilities, safety showers, eyewash fountains are also essential.

7.3 Facilities Required — Ventilation, Quick Washing, Drainage — All the three facilities are essentially required and proper provision should be made for them.

7.4 Protection of Persons Engaged — Personnel protection equipment should also be used besides good safe working conditions and adequate ventilation. Persons handling methyl bromide should be provided with the following equipment:

- a) high top safety PVC shoes and woollen/PVC aprons, and
- b) suitable gas tight chemical safety goggles.

NOTE 1 — Leather rubber appliances should not be used as they are affected by methyl bromide.

NOTE 2 — Protective creams or ointments are dangerous and should not be used.

8. WASTE DISPOSAL (SOLID, LIQUID OR GASEOUS)

8.1 Nature of Waste Containing the Chemical — Under normal conditions, methyl bromide is a gas and therefore there are no solids or liquid wastes for disposal. Methyl bromide may be disposed of by burning at a safe location or in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

9. FIRE PREVENTION

9.1 Provision of flame proof electrical equipment may be made in accordance with IS : 2148-1981*.

9.2 Open flames should be strictly prohibited inside the plant. Other ignition sources should be controlled to the maximum extent possible.

9.3 Earthing of individual equipment may be done in accordance with IS : 3043-1966†.

10. HAZARD INFORMATION

10.1 Use of Hazard Warning Symbols in Plant Areas/Labels — Warning in local language should be prominently displayed at important points indicating that methyl bromide area is hazardous. Labels should be on the following lines.

Methyl Bromide

**DANGER — Vapour Extremely Hazardous
Highly Volatile**

*Specification for flame proof enclosures of electrical apparatus second revision).

†Code of practice for earthing.

Causes Burns
Do not Breathe Vapours
Keep Methyl Bromide Away From Eyes, Skin and Clothing
Poison

FIRST AID TREATMENTS — ANTIDOTES:

Remove to fresh air
Use artificial respiration if breathing has stopped
Get immediate medical attention
Keep patient absolutely quite and start oxygen inhalation through suitable equipment

10.2 Cautionary and Warning Notices in Plant — Such notices should be prominently displayed at important places in local language.

10.3 Information on Labels — As in 10.1.

10.3.1 Additional Information — When used for fumigation, 2 percent chloropicrin by mass is added to methyl bromide as a warning agent.

11. PERSONAL PROTECTIVE EQUIPMENT

11.1 Suggested Respiratory Protective Devices — Oxygen breathing apparatus should be used when concentrations of methyl bromide in air are not known. Alternatively, if a non-contaminated compressed air source is available, the supplied air mask (positive pressure suit) may also be used. If the concentration of gas is below 1 percent (by volume) cannister gas mask can be used.

11.2 Suggested Non-Respiratory Protective Devices

- a) Always use gas proof chemical safety goggles,
- b) Use woollen/PVC overall/aprons,
- c) Use plastic coated canvas gloves, and
- d) PVC shoes may be used in cylinder filling operations.

12. TRAINING EDUCATION

12.1 Every person recruited for handling of methyl bromide should undergo a general training regarding safety procedures.

12.2 Everybody working in methyl bromide plant should be familiar with fundamentals of emergency operations.

12.3 Refresher Training — Refresher training courses should be organized after suitable intervals for all workers in general safety and emergency procedures.

13. HEALTH MONITORING

13.1 Everybody should be examined by a qualified industrial physician and certified accordingly for working in methyl bromide plant; any abnormalities in central nervous system and cardio vascular system should not be compromised with.

13.2 Every three months, a complete medical check up is necessary.

13.3 Maintenance of medical record is necessary for every person working in methyl bromide plants. In this connection, respective State Government rules should be followed for maintaining these records.

14. FIRST AID

14.1 Actions in Emergency — Remove the patient from contaminated atmosphere to open and away from contaminated area. Removal of methyl bromide from the skin or eyes is of primary importance. Give the physician a detailed account of the accident. If oxygen is available with trained personnel — administer it. The worker should be given 100 percent oxygen (preferably inhaled against a positive pressure of not more than 6 cm of water). Oxygen inhalation should be instituted even though there are no signs of lung injury and should be carried on for 30 minutes out of each hour, for six hours. If respiration is weak or fails, give artificial respiration, at the same time continuing oxygen inhalation.

14.1.1 Periodic biological monitoring (urine and blood) should be carried out to check early exposure of methyl bromide.

14.1.2 There may be considerable delay between an acute exposure to methyl bromide and detectable signs or symptoms. Hence immediate attention should be given to all workers suspected to have been exposed to concentrations of the order of 200 ppm or more. Symptoms like headache, nausea, vomiting or dizziness, however slight, could be taken as indications for immediate treatment.

14.2 Eye and other affected parts should be washed with water for at least 15 minutes. The eyelids should be held apart during washing.

14.3 Do not give drugs which may interfere with respiratory centre or with proper oxygenation, for example, morphine, barbiturates or sulfa drugs. Drugs noted for control of secondary infection are best used, when signs of circulatory collapse and anoxia have disappeared. If severe irritation of the upper respiratory tract causes bronchial spasm or laryospasm, inhalation adrenalin solution (1 : 100) is of value. This inhalation should continue until functional congestion has been relieved and respiration is unobstructed.

(Continued from page 2)

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